ample density without it; no clearing baths are necessary, and the original developer works excellently for the second treatment—in all these details the manipulation of the new plate is simpler than what is desirable, if not necessary, in the case of the autochrome. The colours of the omnicolore plate are much more transparent than those of the autochrome, being applied as paints or varnishes instead of being absorbed by translucent starch granules; but this method has its drawbacks as well as its advantages, for the density of the colour is not even all over each little patch of red and green. The colour is lighter towards the margins of the patches, and their shapes, too, are rather irregular, but doubtless improvements will be made in these directions. The plates, as they are, are simple and easy to manipulate, and give results that must be distinctly useful to those who wish to reproduce, or, more correctly, to imitate, by the simplest known method, the colours of the objects they photograph.

## OUR ASTRONOMICAL COLUMN.

OBSERVATIONS OF COMET MOREHOUSE.—Comet 1908*c* was observed, with the 284 mm. Amici equatorial, at Arcetri on forty-one days between September 4 and December 7, 1908, and 127 determinations of its position were made with the micrometer. These are now recorded by Prof. Abetti in No. 4316 of the *Astronomische Nachrichten*, together with a valuable set of notes describing the comet's visual appearance on a number of days.

Mr. Metcalf's note and excellent photographs are also reproduced, from the Harvard Circular No. 148, in the same journal.

A series of six photographs taken at the Dominion Observatory, Ottawa, between October 6 and November 26, is reproduced and described by Mr. Motherwell in No. 1, vol. iii., of the Journal of the Royal Astronomical Society (Canada). The comet was visible at Ottawa for more than three months, but dense smoke and unusual cloudiness prevented an extensive series of photographs from being obtained. Those reproduced show similar knots in, and displacements of, the tail-matter, as previously recorded. On October 20 the head of the comet passed over an eighth-magnitude star without perceptibly dimming it.

Observations of the comet, made with a sextant on board the German steamship *Paranaguà*, are recorded in No. 4317 of the *Astronomische Nachrichten*.

MEASURES OF DOUBLE STARS.—The micrometer measures of double stars made by Dr. Lau and Herr Luplau-Janssen at the Copenhagen Observatory during 1908 are recorded in No. 4315 of the *Astronomische Nachrichten*. The stars observed chiefly lie between declinations 0° and 20°, special attention having also been paid to neglected pairs. In addition to the date, position-angle, and distance, the authors give brief notes concerning the colours of the components, and, where possible, compare the values obtained with those computed from previously published elements.

DIAMETER AND POSITION OF MERCURY.—In these columns on December 24, 1908 (No. 2043, vol. lxxix., p. 232), we noted the corrections to the diameter and position of Mercury, derived by Prof. Stroobant from the observations of the transit of the planet, on November 14, 1907, made at thirty-three observatories. Since the publication of the memoir in which he gave those corrections, Prof. Stroobant has received observed values from eleven additional observers, and has incorporated them in the final results which appear in No. 4317 of the *Astronomische Nachrichten*.

These show, from the time between first and second contact, that the planet's apparent diameter was $9''\cdot166$, whilst the observations of the third and fourth contacts give, similarly, $9''\cdot092$. These values correspond to diameters, at unit distance, of $6''\cdot20$ and $6''\cdot15$ respectively, the latter being probably the more correct.

The corrections to the equatorial and ecliptical co-ordinates are found to be $\Delta\alpha = +0\cdot070s.$, $\Delta\delta = -0''\cdot25$, and $\Delta\lambda = +1''\cdot03$, $\Delta\beta = +0''\cdot02$, respectively, in the sense observed-calculated.

The agreement of the Italian observations of this passage of Mercury with the data given in various ephemerides is discussed by Signor Pio Emmanuelli in No. 110 of the *Revista di Fisica, Matematica e Scienze Naturali* (Pavia) for February.

THE VATICAN OBSERVATORY.—We learn from the *Times* Milan correspondent that the inauguration of the new section of the Vatican Observatory, which was to have taken place on March 18, was postponed because one of the components of the 40-cm. object-glass for the new equatorial refractor was found to be defective, and has to be re-cast.

When this new section is complete the Gregorian Specola will be abandoned, and the whole of the observatory will be located on the summit of the Vatican hill, 100 metres above the square of St. Peter's, where Father Lais has been engaged, since 1891, in taking the photographs for the International Astrographic Chart (the *Times*, Engineering Supplement, April 7).

## PRODUCER GAS FOR ENGINES.

### I.—PROCESSES AND PLANTS.

IT is well known that what is technically called 'producer gas" has been in use for many years in connection with furnace work. Herr Bischof, of Mägdesprung, was the first to use an internally fired gas producer for this purpose in 1839; but little progress was made in our country until 1857, when the late Sir William Siemens introduced the combined gas producer and regenerative furnace with which his name is associated. Some twenty years later it occurred to me that a gas engine might be worked with producer gas if a suitable plant were devised. For furnace work the hot gas is taken direct from the producer to the furnace without cooling or cleaning, and the condensable hydrocarbon vapours, which usually accompany the gas, and add appreciably to its value, are burnt. But for engine work it is essential to wash and clean the gas, especially as it must be free from tar. It is also desirable that the gas should be cool when it enters the cylinder of the engine. Incidentally, this involves the removal by condensation, &c., of the condensable hydrocarbons which leave the producer, and after their removal the gas must still be strong enough to fire well and give good working results in the engine. I succeeded in making a suitable plant, and it was first tried with a small Otto engine in 1879; the results were good, and they encouraged the makers of the engines to build them of larger size so as to compete favourably with steam-power. Many thousands of horse-power are now working with gas plants of this type, and during the last few years a still further impetus has been given to the subject by the use of a modified plant, which is known among engineers as a *suction plant*, and which will be more fully described later.

For the moment we will consider briefly the process of making producer gas, and some of the chemical reactions involved. Producer gas is made by forcing or drawing air, with or without the addition of steam or water vapour, through a deep bed of incandescent fuel in a closed producer. Usually the fuel is fed in at the top, and the currents of air, or of steam and air, enter at the bottom, the gas outlet being near the top. An important characteristic of the process is that no external heat is applied to the producer, as in the case of an ordinary gas retort. When once the burning of the fuel *inside* the producer has been started, the air which is used to make the gas keeps up a continuous process of combustion, and a sufficiently high temperature is maintained to decompose the steam and to effect other necessary reactions.

We know that if there were a shallow fire of carbonaceous fuel and a sufficient supply of air, the carbon would be completely oxidised. The product of this complete combustion would be carbon dioxide, with the development of a large amount of sensible heat; but if there were a considerable depth of carbon in the producer (as there should always be in practice) the resulting gas would be carbon